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EFFECTS OF CONTINUOUS AND INTERMITTENT REINFORCEMENT FOR PROBLEM BEHAVIOR DURING FUNCTIONAL COMMUNICATION TRAINING

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We evaluated the effectiveness of functional communication training (FCT) in reducing problem behavior and in strengthening alternative behavior when FCT was implemented without extinction. Following the completion of functional analyses in which social-positive reinforcement was identified as the maintaining variable for 5 participants' self-injurious behavior (SIB) and aggression, the participants were first exposed to FCT in which both problem behavior and alternative behavior were reinforced continuously (i.e., on fixed-ratio [FR] 1 schedules). During subsequent FCT conditions, the schedule of reinforcement for problem behavior was made more intermittent (e.g., FR 2, FR 3, FR 5, etc.), whereas alternative behavior was always reinforced according to an FR 1 schedule. Results showed that 1 participant's problem behavior decreased and alternative behavior increased during FCT when both behaviors were reinforced on FR 1 schedules. The remaining 4 participants shifted response allocation from problem to alternative behavior as the schedule of reinforcement for problem behavior became more intermittent. These results suggest that individuals might acquire alternative responses during FCT in spite of inconsistencies in the application of extinction, although even small errors in reinforcement may compromise treatment effects.

DESCRIPTORS: functional analysis, functional communication training, intermittent reinforcement, extinction, self-injurious behavior, aggression

Functional communication training (FCT; Carr & Durand, 1985) has become a popular treatment for behavior disorders in individuals with developmental disabilities. FCT typically contains two procedural components characteristic of a differential-reinforcement-of-alternative-behavior (DRA) contingency: (a) Reinforcement for problem behavior is discontinued (extinction), and (b) an alternative behavior is prompted or shaped using the same reinforcer that maintains problem behavior (reinforcement of an alternative mand).

A great deal of emphasis has been placed on the reinforcement component of FCT, yet results from several studies indicate that the extinction component may be just as important to the success of FCT interventions. For example, Shirley, Iwata, Kahng, Mazaleski, and Lerman (1997) compared the effectiveness of FCT with and without extinction in decreasing self-injurious behavior (SIB) and in establishing an alternative response (a manual sign) with 3 participants. During FCT without extinction, when both SIB and signing produced access to reinforcement on a continuous basis (i.e., a fixed-ratio [FR] 1 schedule), all participants continued to exhibit high rates of SIB and failed to acquire the alternative response. When FCT was implemented with extinction, all participants showed decreases in SIB and increases in signing. Similar results were reported by Hagopian, Fisher, Sullivan, Acquisto, and LeBlanc (1998), who examined the contributions of extinction and punish-

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ment when used in combination with FCT for 21 individuals who exhibited a wide range of problem behaviors. They found that FCT without extinction or punishment produced a 90% reduction in problem behavior in none of the cases in which it was applied, whereas FCT combined with extinction or punishment produced 90% reductions in problem behavior in 81% of the cases.

Thus, results such as those reported by Hagopian et al. (1998), Shirley et al. (1997), and others (e.g., Fisher et al., 1993; Wacker et al., 1990) suggest that decreases in problem behavior, as well as increases in alternative behavior, may be difficult to produce unless problem behavior is placed on extinction. The use of extinction, however, poses several potential difficulties. First, extinction may produce negative side effects, including extinction bursts, aggression, and emotional behavior (Lerman, Iwata, & Wallace, 1999). Second, problem behavior such as SIB and aggression may become so severe at times that it must be interrupted. Such attempts to prevent the individual from engaging in dangerous behavior may involve inadvertent delivery of attention or termination of ongoing tasks, thereby resulting in intermittent reinforcement for problem behavior. Finally, intermittent reinforcement may also occur if therapists (or parents, teachers, etc.) apply treatment in an inconsistent manner. For these reasons, the use of extinction may sometimes be undesirable, infeasible, or unlikely.

Although results from research in which FCT was implemented without extinction have generally produced negative findings, these studies were conducted under conditions in which problem behavior was continuously reinforced when extinction was not in effect. A different situation exists when FCT is implemented under conditions of intermittent reinforcement, which are likely to occur in the natural environment when therapists either cannot or do not implement treatment consistently. That is, therapists may occasionally make errors that partially degrade the integrity of treatment when either (a) extinction is not implemented consistently for problem behavior or (b) reinforcement does not consistently follow appropriate behavior. An example of this type of arrangement was evaluated by Horner and Day (1991). After determining that 1 student's SIB was maintained by obtaining the therapist's assistance with difficult tasks, the authors taught the student the manual sign for "help." Subsequently, different schedules of reinforcement for signing (FR 1 and FR 3) were assessed while the schedule of reinforcement for SIB remained constant at FR 1 (i.e., no extinction). Results showed that when signing was intermittently reinforced (FR 3 schedule), signing decreased and SIB increased. By contrast, when both signing and SIB produced reinforcement according to FR 1 schedules, SIB dropped to near zero and high levels of signing were observed. These findings suggest that intermittent reinforcement of appropriate behavior may be deleterious to treatment effectiveness when problem behavior continues to be reinforced.

In a more recent investigation, Vollmer, Roane, Ringdahl, and Marcus (1999) examined a DRA intervention at various levels of treatment integrity. Following a condition in which treatment was implemented at full integrity (alternative behavior was reinforced 100% of the time and problem behavior was reinforced 0% of the time), 3 participants were exposed to several schedules of partial implementation. For example, under the 75/25 schedule, appropriate behavior was reinforced 75% of the time, whereas problem behavior was reinforced 25% of the time. Results generally showed that appropriate behavior was maintained at high levels and problem behavior was maintained at low levels under partial schedules in which appro-

priate behavior was reinforced more often than problem behavior.

Results of the Vollmer et al. (1999) and Horner and Day (1991) studies suggest that FCT and DRA interventions may produce positive outcomes in spite of inconsistent treatment implementation. However, the manipulations of treatment integrity in those studies were undertaken only after the alternative behaviors had been acquired while problem behaviors were extinguished. Thus, it is unclear whether behavior change (a decrease in problem behavior and an increase in alternative behavior) would have been produced initially under conditions of intermittent reinforcement (i.e., partial treatment integrity). The purpose of the present study was to examine the effects of intermittent (inconsistent) implementation of FCT by varying the schedule of reinforcement for problem behavior while holding constant the schedule for alternative communication at FR 1. This arrangement approximated one in which therapists consistently reinforced appropriate behavior but failed to implement extinction consistently, resulting in intermittent reinforcement for problem behavior.

GENERAL METHOD

Participants and Setting

Five individuals living in a state residential facility participated. All had been diagnosed with profound mental retardation and had long histories of SIB or aggression. Jed was a 33-year-old man who engaged in SIB consisting of skin biting. Jed was able to follow instructions and had an extensive repertoire of manual signs; however, his signing was often unintelligible. Max was a 37-year-old man whose SIB consisted of banging his hand against hard surfaces. He followed simple instructions and communicated using rudimentary gestures (e.g., pointing, pulling person toward an object). Janet was a 44-year-old woman whose SIB consisted of skin picking. Janet rarely followed instructions and communicated using simple gestures. Annette was a 31-year-old woman whose problem behavior consisted of both SIB (arm banging) and aggression. Annette followed simple instructions and communicated using gestures. Shonnie was a 29-year-old woman whose SIB consisted of head and body hitting and skin biting. Shonnie followed simple directions and communicated using gestures.

All sessions were conducted in therapy rooms at a day-treatment program located on the grounds of the residential facility. Two to four 10-min sessions were conducted daily, 4 to 5 days per week.

Response Measurement and Reliability

The dependent variables were occurrences of problem behavior (SIB and aggression) and an alternative mand. The following topographies of SIB were scored: (a) skin biting: forceful closure of the upper and lower jaw onto the skin; (b) skin picking: contact between a finger or fingernail and the skin; (c) hand or arm banging: forceful contact between a hand or forearm and a hard surface; (d) head or body hitting: forceful contact between a hand and the head or torso. Aggression was defined as follows: (a) hitting: forceful contact between a hand and another person's body; (b) scratching: contact between a fingernail and another person's skin; (c) pinching: closure of two fingers on another person's skin; (d) kicking: forceful contact between a foot and another person's leg; and (e) throwing objects at others.

The alternative mand chosen for Jed, Max, and Annette consisted of handing a therapist a laminated picture card (13 cm by 14 cm) depicting the reinforcer maintaining SIB. Janet's alternative mand consisted of arm raising (lifting a hand above shoulder level), and Shonnie's alternative mand con-

sisted of handing a therapist a plate on which the maintaining reinforcer was placed. Manding was scored as independent if it occurred without assistance from the therapist or as prompted if it was emitted with the assistance of the therapist.

Data were recorded by trained observers on handheld computers (Assistant Model A102) and were calculated as number of responses per minute. A second observer simultaneously but independently collected data during at least 25% of functional analysis sessions and at least 30% of FCT sessions. Agreement percentages were calculated by dividing session time into continuous 10-s intervals and comparing observers' records on an interval-by-interval basis. The smaller number of responses recorded in each interval was divided by the larger number of responses; these fractions were averaged and multiplied by 100%. Mean interobserver agreement for problem behavior was 97.7% (range, 95.3% to 99.7%) during functional analysis sessions. Mean agreement scores for problem behavior and alternative behavior, respectively, were 97.3% (range, 95.1% to 99.8%) and 97.4% (range, 96.0% to 98.8) during baseline and treatment sessions.

Phase 1: Functional Analysis

Procedure

All participants were exposed to a functional analysis to identify maintaining contingencies for their problem behavior. Four to five conditions were alternated in a multielement design, based on procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). The attention condition served as a test for sensitivity to social-positive reinforcement (contingent attention). The participant and a therapist were present in a room containing leisure items. The participant had free access to the leisure items throughout the session, and the therapist ignored the participant except to deliver brief attention in the form of statements of concern (e.g., "Don't do that, you'll hurt yourself [me]") following each occurrence of problem behavior. The tangible condition was a variation of the attention condition and was included only if either previous observations or caregiver reports suggested that a participant's problem behavior was maintained by access to tangible reinforcers. The participant and a therapist were present in a room. Prior to the session, the participant was given brief, noncontingent access to preferred foods or leisure items. These items were removed at the beginning of the session but, following each instance of problem behavior, either one piece of food was delivered or leisure items were provided for 30 s. The demand condition served as a test for sensitivity to social-negative reinforcement (escape from task demands). The participant and a therapist were seated at a table containing several task-related materials. The therapist presented learning trials to the participant using a three-prompt sequence (instruction, gestural prompt, physical prompt) in either a continuous series (Annette) or at 30-s intervals (all others). The therapist delivered praise if the participant complied with the task but terminated the trial (removed all task materials and turned away from the participant for 30 s [Annette] or for the remainder of the interval) contingent on the occurrence of problem behavior. The alone condition was a test for the influence of automatic reinforcement (persistence of behavior in the absence of all social consequences). The participant was alone in a room containing no materials. An exception to this occurred in Annette's case: A therapist was present in the room and sat within arm's length of her (to allow aggression to occur) but ignored Annette and provided no consequences for aggression. The play condition served as a control. The participant and a therapist were

present in a room containing a variety of leisure materials. The participant had free access to the leisure items throughout the session, and the therapist delivered attention either continuously (Max and Annette) or according to a fixed-time (FT) 30-s schedule (Jed, Janet, and Shonnie).

Results

Figure 1 shows results of the functional analysis for all participants. Each participant's pattern of responding showed differentiation, in that rates of problem behavior were highest during one of the test conditions. Jed, Max, and Shonnie exhibited their highest rates of problem behavior during the tangible condition, indicating that their problem behavior was differentially sensitive to reinforcement by access to either leisure items (Jed and Max) or edible items as reinforcement (Shonnie). Janet and Annette exhibited their highest rates of problem behavior during the attention condition. Thus, it appeared that all participants' behavior was maintained by social-positive reinforcement (access to tangible items or attention delivered by a therapist). These data were used to determine the baseline conditions in effect prior to treatment, as well as to select the reinforcers to be delivered in the FCT interventions.

Phase 2: Treatment Evaluation

The effectiveness of FCT was evaluated in reversal designs. Participants were first exposed to a baseline condition, followed by FCT without extinction. We examined the effects of FCT without extinction to first determine whether behavior change would occur when problem behavior and alternative behavior were both reinforced continuously (i.e., reinforcement accuracy for alternative behavior was 100%; reinforcement errors for problem behavior were 100%). If so, examination of the effects of intermittent reinforcement for problem behavior would be unnecessary. Next, a series of FCT conditions was conducted in which reinforcement for problem behavior was delivered under progressively more intermittent schedules (reinforcement errors for problem behavior were less than 100%). When decreases in problem behavior and increases in alternative behavior were observed, baseline was reinstated, followed by a return to the previous FCT condition. An exception to this sequence occurred for Janet, whose FCT evaluation did not contain a reversal. Her participation in the study was terminated before a reversal could be conducted for reasons unrelated to her behavior problem or the treatment program.

Baseline

The baseline condition for each participant was identical to the functional analysis condition in which the highest rate of problem behavior was observed. That is, occurrences of problem behavior during baseline produced either 30-s access to leisure items (Jed and Max), a small piece of food (Shonnie), or brief verbal and physical attention (Janet and Annette) on a continuous (FR 1) schedule. No consequences were delivered for those alternative responses that could occur during baseline (manual signs only, Janet and Shonnie). Picture cards (Jed, Max, and Annette) were unavailable as alternative responses during baseline.

FCT Without Extinction: Problem Behavior (FR 1) and Alternative Behavior (FR 1)

During this condition, a delayed prompting procedure identical to that described by Shirley et al. (1997) was used to shape the alternative behavior. As during baseline, occurrences of problem behavior produced access to maintaining reinforcers on an FR 1 schedule (i.e., extinction was not in effect). In addition, reinforcement was also delivered on an FR 1 schedule for occurrences of the

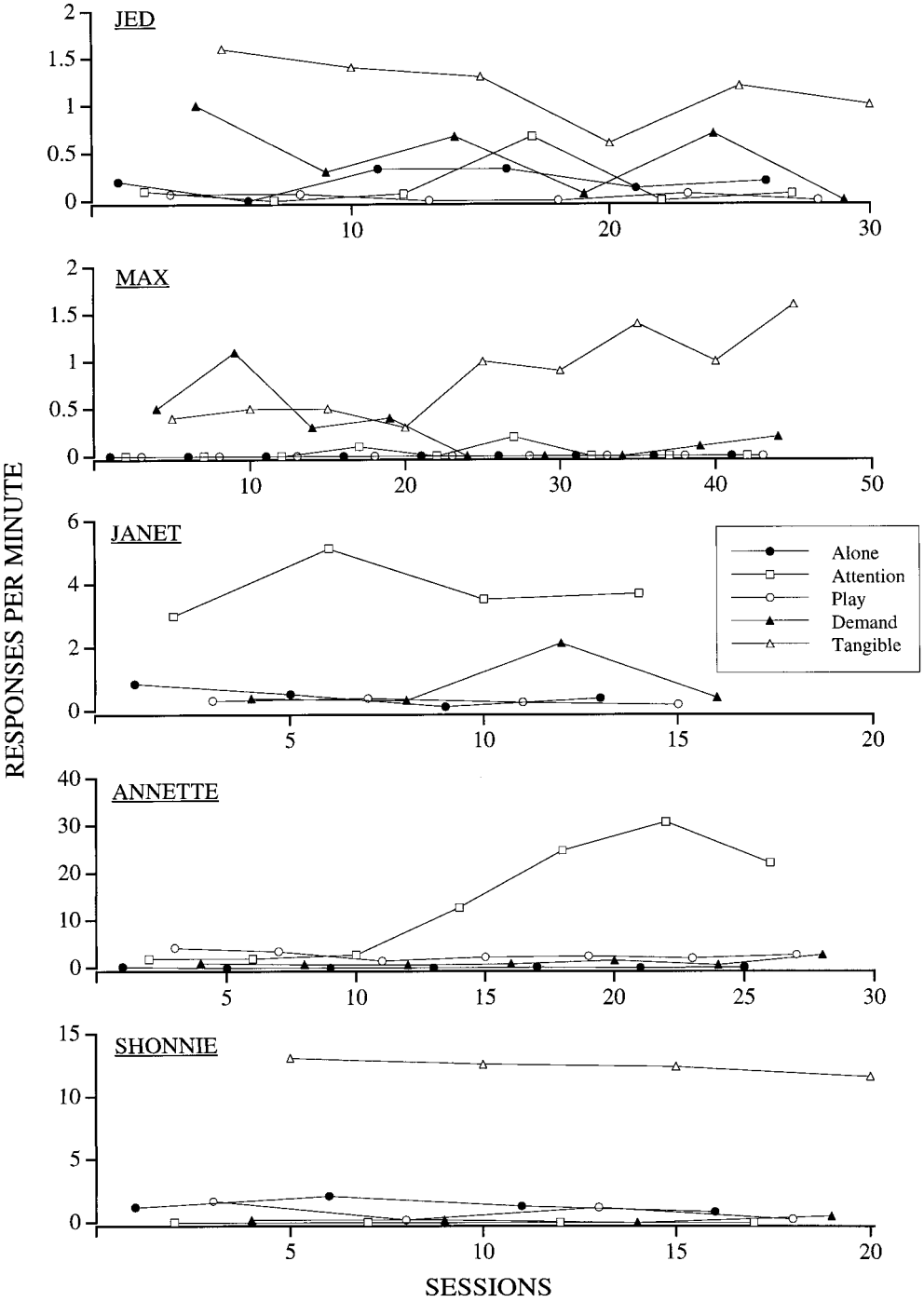

Figure 1. Responses per minute of problem behavior exhibited by each participant across functional analysis conditions.

alternative behavior (prompted or independent). Thus, both problem behavior and alternative responses were reinforced on continuous concurrent schedules (FR 1 FR 1). Alternative behaviors were prompted as follows: If neither problem behavior nor the alternative behavior occurred within 5 s of the beginning of a session, the therapist physically prompted the participant to emit the alternative behavior (produce the sign or hand the picture card or plate to the therapist) and then delivered the reinforcer that was previously demonstrated to maintain problem behavior. That is, prompted or independent manding produced access to leisure materials for 30 s (Jed and Max), one piece of food (Shonnie), or brief verbal and physical attention (Janet and Annette). Following five consecutive prompted alternative responses during which no problem behavior occurred, the prompt was delayed an additional 1 s.

FCT: Problem Behavior (FR > 1) and Alternative Behavior (FR 1)

During subsequent FCT conditions, the schedule of reinforcement for problem behavior was thinned (e.g., FR 2, FR 3, etc.), whereas the schedule of reinforcement for the alternative behavior remained at FR 1. For example, during the FR 2 FR 1 condition, reinforcement was delivered following every other occurrence of problem behavior and after every occurrence of alternative behavior (either prompted or independent). All schedules were initially set at FR 2 FR 1, and reinforcement for problem behavior was faded further during subsequent conditions until rates of alternative behavior exceeded rates of problem behavior.

Results

Figure 2 shows rates of problem behavior and unprompted alternative behavior across baseline and treatment conditions for Jed, Max, and Janet. Jed's results show that, when FCT was implemented without extinction (FR 1 FR 1), problem behavior decreased from its baseline rate and alternative behavior increased throughout the condition. SIB increased when FCT was removed during a return to baseline, and decreased again (while alternative behavior increased) during the final FR 1 FR 1 condition. Thus, Jed's FCT intervention was successful in spite of the fact that problem behavior continued to be reinforced on a continuous basis. Max's data initially showed some similarity to Jed's. That is, implementation of FCT without extinction was associated with a decrease in problem behavior and an increasing trend in alternative behavior. After 13 treatment sessions, however, rates of both behaviors began to show overlap, in that Max switched from one response to the other during sessions. At that point, the reinforcement schedule for problem behavior was thinned (FR 2 FR 1) and was associated with a further increase in alternative behavior, such that there was no overlap between the rates of problem and alternative behavior. Problem behavior increased when baseline was reinstated, and then decreased again (while alternative behavior increased) during the final FR 2 FR 1 condition. Janet's problem behavior occurred at variable rates, and her alternative behavior (arm raising) never occurred during baseline. During the FR 1 FR 1 and FR 2 FR 1 conditions, rates of problem behavior showed little or no systematic decrease, although an increase in signing was observed during both conditions. During Janet's final condition (FR 3 FR 1), rates of problem behavior decreased and remained at zero for the last nine sessions, while her signing increased to rates similar to those observed for problem behavior during previous conditions.

Figure 3 shows rates of problem behavior and unprompted alternative behavior across baseline and treatment conditions for Annette and Shonnie. Annette exhibited high

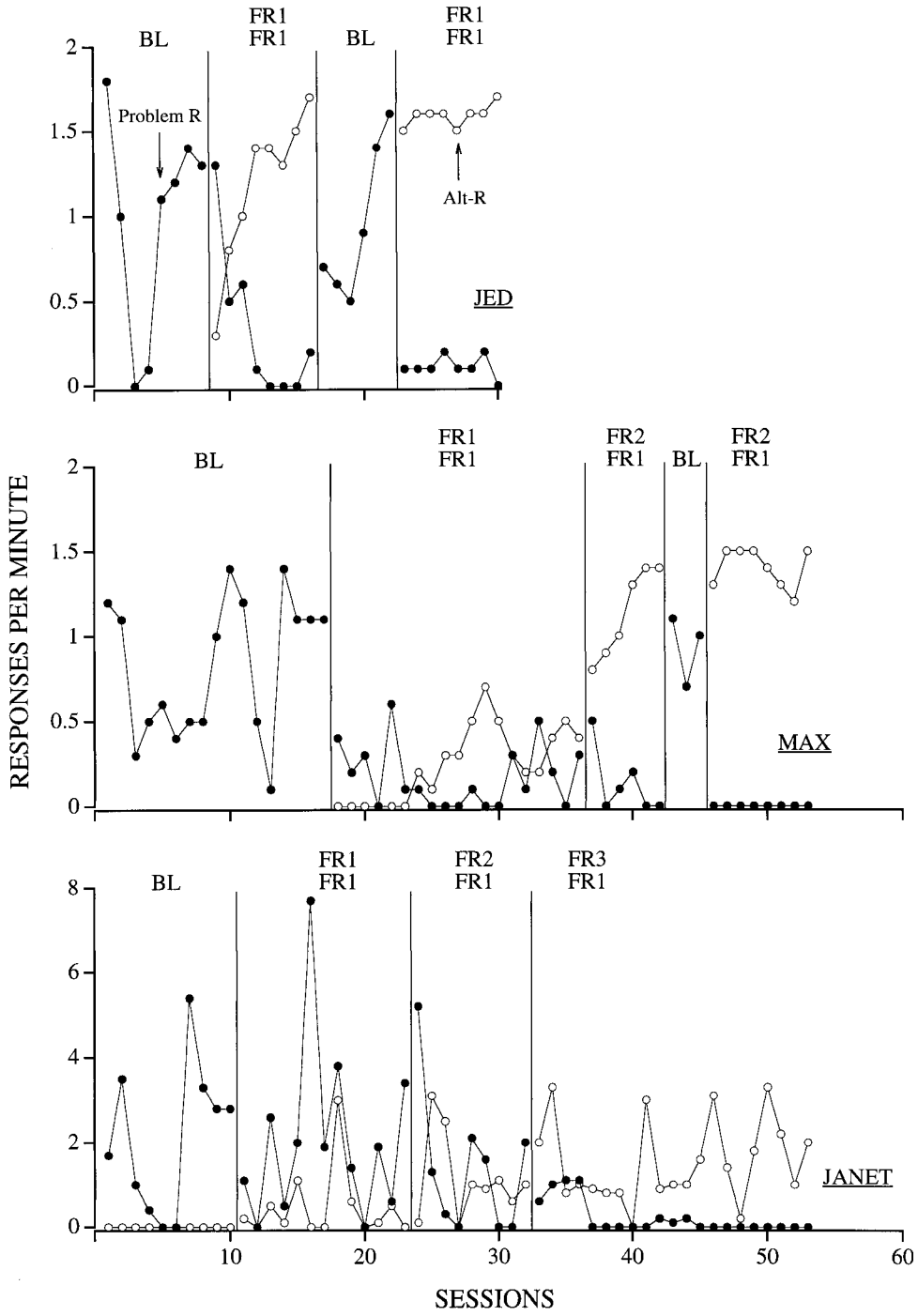

Figure 2. Rates of problem behavior (Problem R) and independent alternative behavior (Alt-R) exhibited by Jed, Max, and Janet during baseline (BL) and FCT treatment (FR) conditions. The top FR value denotes the reinforcement schedule for problem behavior; the bottom value denotes the schedule for alternative behavior.

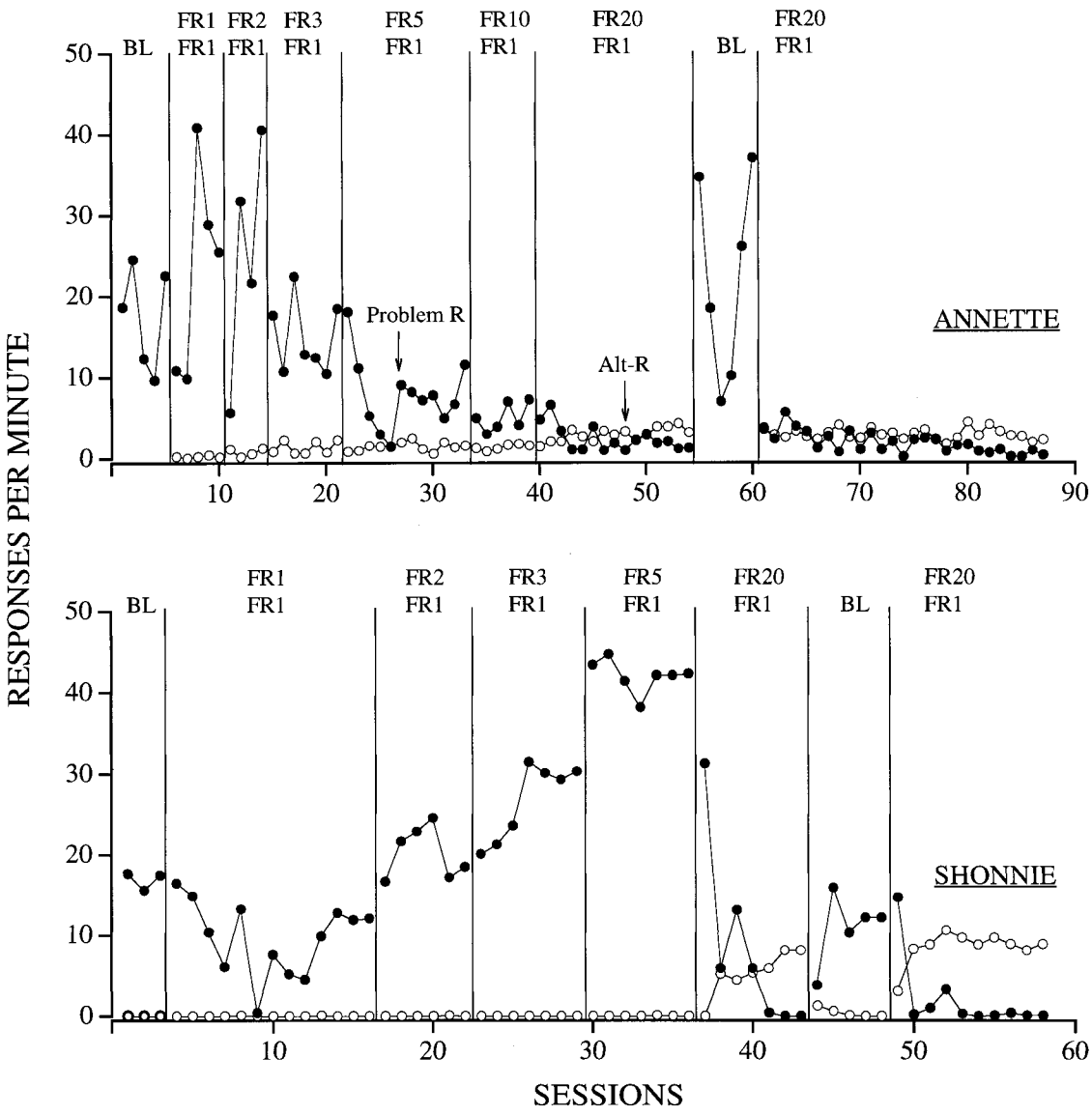

Figure 3. Rates of problem behavior (Problem R) and independent alternative behavior (Alt-R) exhibited by Annette and Shonnie during baseline (BL) and FCT treatment (FR) conditions. The top FR value denotes the reinforcement schedule for problem behavior; the bottom value denotes the schedule for alternative behavior.

rates of problem behavior during baseline. During the next two conditions (FR 1 FR 1 and FR 2 FR 1), her problem behavior increased somewhat above baseline levels, and her alternative behavior (handing a picture card to the therapist) occurred at very low rates. Problem behavior decreased during each of the next three conditions (FR 3 FR 1, FR 5 FR 1, FR 10 FR 1) but still occurred at higher rates than alternative behavior even during the FR 10 FR 1 condition. Rates of alternative behavior first exceeded rates of problem behavior during the FR 20 FR 1 condition. Problem behavior increased during a return to baseline and decreased again when the FR 20 FR 1 condition was reinstated. However, alternative behavior did not consistently exceed problem

behavior until approximately 20 treatment sessions had been conducted during the final FR 20 FR 1 condition.

Shonnie also exhibited high rates of problem behavior during baseline. During the FR 1 FR 1 condition, her problem behavior decreased only slightly and she never exhibited any alternative responses. During each of the next three conditions (FR 2 FR 1, FR 3 FR 1, and FR 5 FR 1), problem behavior increased. Because rates of problem behavior during FR 5 FR 1 were more than twice as high as they were in baseline, and because she still had not exhibited any unprompted alternative responses, the next condition consisted of FR 20 FR 1 (instead of FR 10 FR 1). Shonnie's problem behavior continued to occur at a high rate during the first session of FR 20 FR 1. During subsequent sessions, however, her problem behavior decreased and her alternative behavior increased. Following a return to baseline, during which problem behavior increased and alternative behavior decreased, the FR 20 FR 1 condition was reinstated and again was associated with low rates of problem behavior and high rates of alternative behavior.

DISCUSSION

We evaluated the effectiveness of FCT in reducing problem behavior and in strengthening alternative behavior when FCT was implemented without extinction. When reinforcement was available for problem and alternative behavior under equal schedules (FR 1 FR 1), 1 participant (Jed) showed decreases in problem behavior and increases in alternative behavior. Similar results were obtained with the other 4 participants during subsequent phases, when reinforcement for problem behavior became more intermittent. That is, as the schedule of reinforcement for problem behavior became thinner relative to that for alternative behavior, all participants eventually showed preference for alternative behavior. These results indicate that problem behavior may be replaced with a more appropriate alternative without the use of extinction, although in some cases even small errors in reinforcement appeared to compromise treatment effects.

The present results extend those from previous research in several ways. First, they replicate findings reported by others (e.g., Hagopian et al., 1998; Shirley et al., 1997) that FCT may have little therapeutic benefit when it is implemented without extinction. Only 1 of the 5 participants showed decreases in problem behavior and increases in alternative behavior when both behaviors were reinforced under FR 1 schedules. However, unlike the Hagopian et al. and Shirley et al. studies, we also exposed participants to FCT in which problem behavior was reinforced on intermittent schedules, which may resemble more closely the types of treatment inconsistencies that might occur in the natural environment. The 4 participants who were exposed to this arrangement all showed decreases in problem behavior and increases in alternative behavior. Thus, our findings with respect to initial behavior change under intermittent reinforcement extend results that Vollmer et al. (1999) recently reported with respect to maintenance.

The response patterns exhibited by individual participants in this study were quite varied and deserve comment. Jed's results, which showed decreases in problem behavior and increases in alternative behavior during the FR 1 FR 1 condition, were inconsistent with those reported by Shirley et al. (1997). It is unlikely that his results could be attributed to other parametric differences such as response effort or the delay, quality, or magnitude of reinforcement because these all appeared to be similar for the two responses. In fact, Jed's problem behavior (skin biting) seemed, if anything, less effortful than his alternative response (handing a card to the therapist). It is possible that Jed selected the

alternative behavior over problem behavior because problem behavior produced at least some negative consequences (i.e., pain). When social reinforcers such as attention maintain SIB by overriding SIB's painful effects, it should not be surprising that at least some individuals readily choose an alternative means of gaining the same reinforcement.

Results obtained for Max, Janet, and Annette under FR 1 FR 1 schedules were consistent with those reported by Shirley et al. (1997), and results for these participants during subsequent FCT conditions were consistent with findings from research on choice under unequal concurrent reinforcement schedules (see Fisher & Mazur, 1997, for a recent review). That is, given FR 1 reinforcement for the occurrence of alternative behavior, that response (choice) became more likely as reinforcement for problem behavior became more intermittent (FR 2 for Max, FR 3 for Janet, and FR 20 for Annette). However, Annette's rates of alternative behavior did not exceed her rates of problem behavior until there was a large disparity between the reinforcement schedules for these behaviors (FR 20 FR 1), and consistent performance was not obtained until many sessions were conducted at FR 20 FR 1 (this was especially true during her second exposure). Thus, Annette failed to choose alternative behavior over problem behavior until the commission errors for reinforcement of problem behavior fell to below 5% and the omission errors for reinforcement of alternative behavior were 0%. Based on Annette's data, it appears that even small reinforcement errors may compromise FCT treatment effects.

Shonnie's results were the most unexpected. During her first three FCT conditions in which problem behavior was reinforced intermittently (FR 2 FR 1, FR 3 FR 1, and FR 5 FR 1), problem behavior increased progressively, whereas unprompted alternative behavior never occurred. Her behavior during these conditions showed a high degree of sensitivity to the reinforcement schedule for problem behavior but complete insensitivity to the reinforcement schedule for alternative behavior. Although these results are difficult to explain definitively, they can be attributed in part to Shonnie's failure to contact prompts for the alternative behavior. That is, her rates of SIB were so high under the intermittent reinforcement conditions that she met the criterion for reinforcement of problem behavior before she met the criterion for prompted alternative behavior. Thus, Shonnie's data suggest that strengthening alternative behavior during FCT may be very difficult, even when problem behavior produces a much lower rate of reinforcement, unless steps are taken to prevent the occurrence of problem behavior (e.g., through response blocking).

The present study contained several limitations that must be considered when interpreting the results. First, because all participants experienced intermittent reinforcement for problem behavior during FCT in the same ascending order (FR 1, FR 2, FR 3, FR 5, etc.), it is possible that reductions in problem behavior were in part due to sequence effects. Perhaps a more convincing demonstration would have been made if the order of schedule thinning were reversed for some participants.

Second, although data for all participants showed positive outcomes when FCT was implemented without extinction, the extent to which better outcomes would have been observed had extinction been used is unknown. We purposely did not expose participants to FCT plus extinction in order to minimize historical influences that may have affected behavior during subsequent FCT conditions without extinction. However, it is possible that either more complete suppression of problem behavior or more rapid be-

havior change would have been observed under extinction.

Third, although extinction was not a programmed component of FCT, thin schedules of reinforcement for problem behavior (especially FR 20 for Annette and Shonnie) may have been functionally equivalent to extinction. That is, at higher schedule values, participants may not have met the response requirement needed to contact reinforcement during a session, thereby eliminating the contingency between problem behavior and its maintaining reinforcer. For example, Annette and Shonnie seldom contacted reinforcement for problem behavior during the FR 20 FR 1 condition because they usually emitted fewer than 20 instances of problem behavior in most sessions. For this reason, the conclusion that their problem behavior was reduced in the absence of extinction must be considered tentative.

Fourth, as noted by Vollmer et al. (1999), implementation of FCT and DRA procedures could involve two types of errors: failure to use extinction and failure to reinforce alternative behavior. In the present study, only the first type of error was examined because we were specifically interested in conducting a more fine-grained analysis of the extinction component of FCT. Therefore, extensions of our results are limited to those situations in which extinction is not implemented consistently, resulting in inadvertent reinforcement for problem behavior.

In spite of these limitations, the present data provide useful information about some of the parametric determinants of successful treatment with FCT and other interventions derived from DRA contingencies. Although it is unlikely that a therapist would recommend intermittent reinforcement of problem behavior to parents or teachers, or that these individuals would inadvertently deliver such reinforcement as precisely as was done in the present study, a large proportion of behavioral interventions are implemented inconsistently in the natural environment. Nevertheless, following the completion of our study, caregivers were trained to implement the FCT intervention at full treatment integrity (i.e., problem behavior reinforced 0% of the time and alternative behavior reinforced 100% of the time).

In summary, the current findings suggest the importance of determining the impact of certain types of errors on treatment outcome. Methodologies such as those exemplified here and in recent studies by Northup, Fisher, Kahng, Harrell, and Kurtz (1997) and by Vollmer et al. (1999) might therefore be used for a variety of purposes, including (a) evaluation of the general robustness of a given intervention or class of interventions, (b) identification of critical errors (or the amount of a given error) that may render a treatment completely ineffective, and (c) assessment of maintenance effects under less than ideal conditions prior to the termination of an intensive treatment program.

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STUDY QUESTIONS

1. Why might it be helpful to evaluate the effects of intermittent reinforcement schedules during treatment consisting of functional communication training (FCT) or other reinforcement-based procedures?

2. How did the results of the functional analyses influence the way in which the various FCT interventions were developed?

3. Describe the prompting procedure for alternative behavior that was used during FCT.

4. Why was FCT first evaluated without extinction?

5. Describe the three patterns of results obtained during the FCT evaluation.

6. What explanation did the authors provide to account for Shonnie's failure to acquire the alternative behavior throughout most of treatment? What data could have been presented to help substantiate this claim, and how might the FCT procedure have been modified to prevent the problem?

7. How might the thin schedules of reinforcement for problem behavior (e.g., FR 20) have been functionally equivalent to extinction?

8. How might the methods and findings of studies such as the present one be helpful in evaluating treatment effects?

Questions prepared by Jana Lindberg and Michele Wallace, The University of Florida